PROJECT FINAL REPORT

Implementation of Reviewers' overall recommendations at the EDEN review meeting (M18) during the second project period

FCH JU Grant Agreement number: **303472**

Project acronym: **EDEN**

Project title: **High energy density Mg-Based metal hydrides storage system**

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Within the EDEN project review meeting, a set of overall recommendations were prepared by reviewers.

The main recommendations and how they have been assessed during the second project period are described in the below table:

Recommendations	Implementation action
As a concern for kinetics optimization, it is recommended to determine whether the location of the Nb2O5 catalyser is more effective at Mg surface, in bulk or at both places.	The effectiveness of the catalyst is directly demonstrated within the development and validation of the catalysed material through the PVD process applied to Mg powders. In this option, around 50 ppm of catalyst, deposited on the surface of the material, have an equivalent effect for the kinetic behaviour of the material of around 3wt.% catalyst directly milled in the HEBM process. There is a clear evidence that the main effect for the kinetics is involving the surface, where the main limitation to kinetics exists. As a second validation of this phenomena, within the Flagship Graphene, in the task hydrogen storage, FBK has developed nanostructures of Mg hydrides with Nb2O5 catalyst. The Mg cluster size distribution was between 2 and 5 nm, to allow for a reduced enthalpy of reaction. In this case, with a much greater surface area of the Mg clusters, the kinetics were largely reduced respect the similar material at bigger dimensions.
Discharging of the phase change material (PCM). The suppression of the PCM may affect the overall efficiency of the system and constraints its operation conditions.	This is not true. The overall efficiency of the system may come from the utilization of exothermic heat generated in the different processes (fuel cell mode). This can’t be utilized in part due to lower temperatures available not matching the ones required for desorption of hydrogen in the tank. To balance this gap, a hydrogen burner has been introduced in the system, with the aim to have the highest efficient configuration and at the same time a flexible configuration able to adapt the working modes to the system requirements.
The fuel cell in reversible mode needs extra devices (hydrogen compressor, water removal system) for operating as an electrolyser, which increases the complexity of the system. The SOFC and Hydrogen Tank have to be completed as quickly as possible in order to decide for the actual configuration of the integrated system in order to identify the specific application it is suitable for.	The electrolyser mode is necessary to charge the hydrogen tank in presence of electricity from renewable energies not directed to self-consumption by end-user. Within this application, hydrogen to be stored in the tank is generated by the electrolyser itself. It is much more convenient to have a reversible solid oxide cell, saving costs for additional components. FBK and partners of EDEN could design the final system layout, to order and assemble components and validate the final integrated system within several cycles in reversible mode operation.
Emphasis should also be placed in identifying as early as possible sites where the final system could be installed and tested and getting data for power and heat from these sites in order to assess whether the developed system can satisfy these demands.	The site for the demo activities was identified along the second project period, considering several options within the municipality of Barcelona. Finally, a site was identified and the demo activities proceeded after an agreement with the Energy Agency of the municipality.